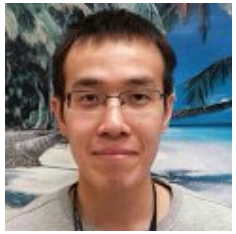
Heavy Flavor TG Report

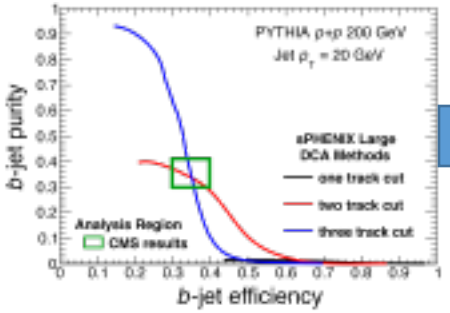
Michael McCumber(LANL), Jin Huang(BNL),
Sanghoon Lim(LANL), Haiwang Yu (NMSU)

b-jet tagging, brief summary for pp

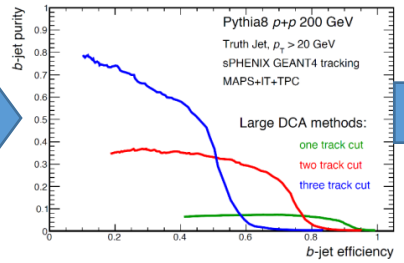
Track Counting



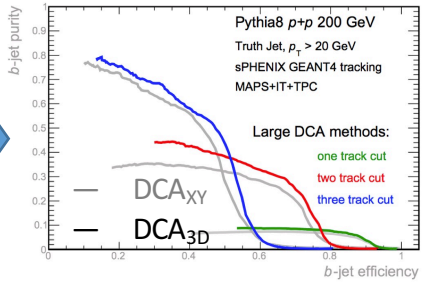
Fast sim in sPHENIX Proposal



Full Geant4 Sim in G4 (DCA_{XY})

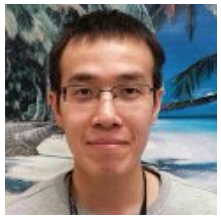


Exploring 3-D DCA in G4

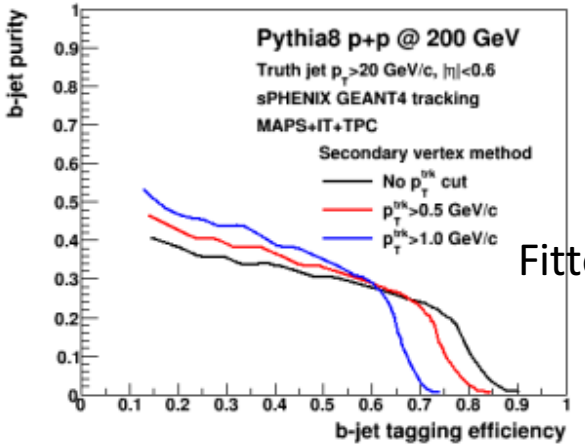


https://indico.bnl.gov/conferenceDisplay.py?confId=1926

Secondary Vertex

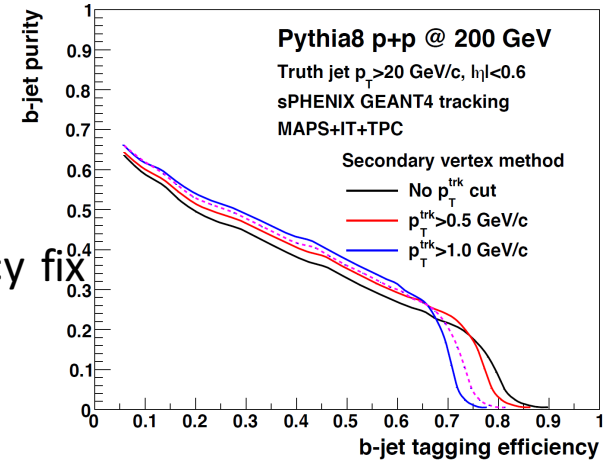


p+p curve in Sept review



Fitter-inefficiency fix

New p+p curve after fix

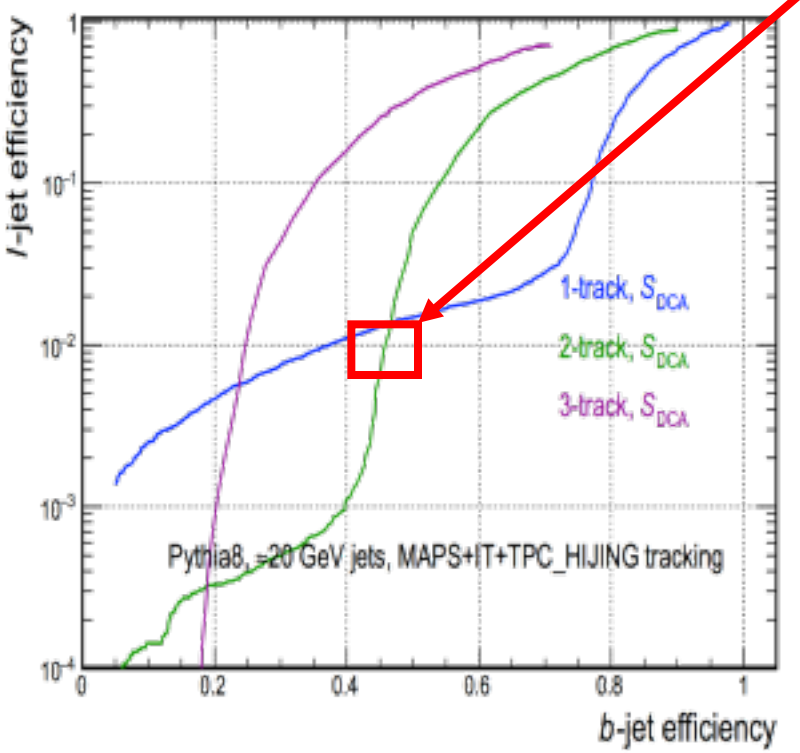


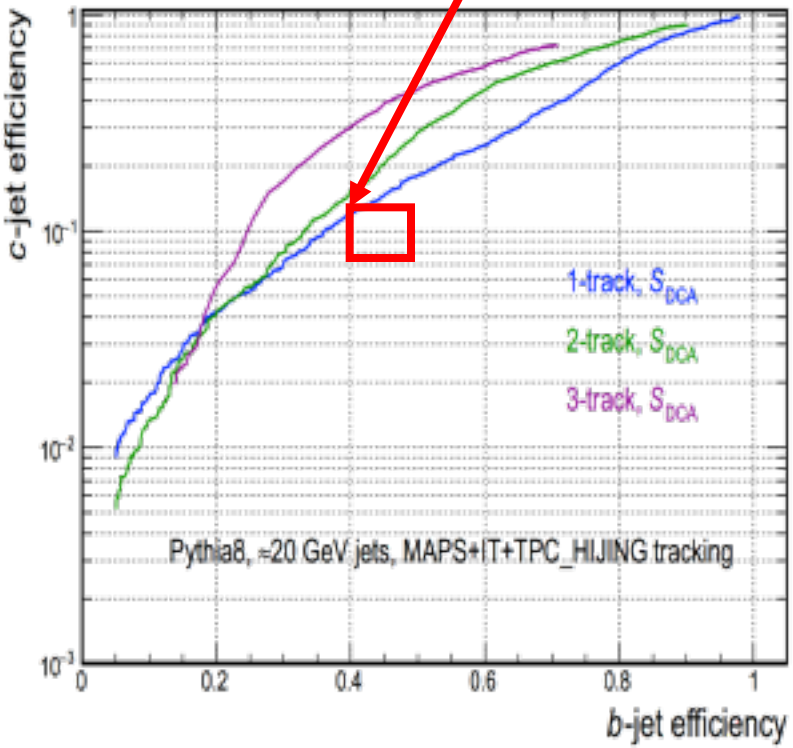
https://indico.bnl.gov/getFile.py/access?contribId=1&resId=0&materialId=slides&confId=2676

large DCA track counting: compare with CMS

sPHENIX: 0-4fm Hijing, 20GeV jet

- comparable with CMS tagging performance: 100:1 l-jet rejection and 10:1 c-jet rejection @ 45% b-jet efficiency. **Phys.Rev.Lett. 113 (2014) no.13, 132301**

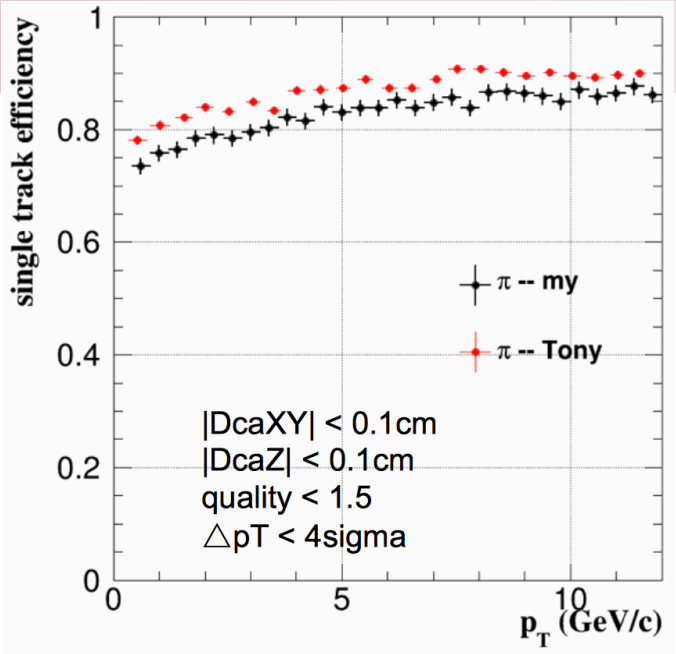


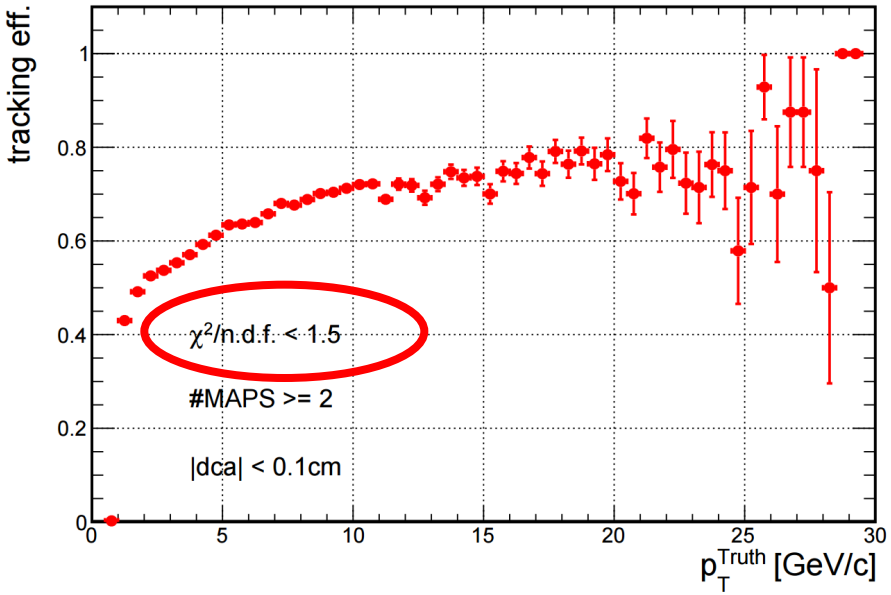


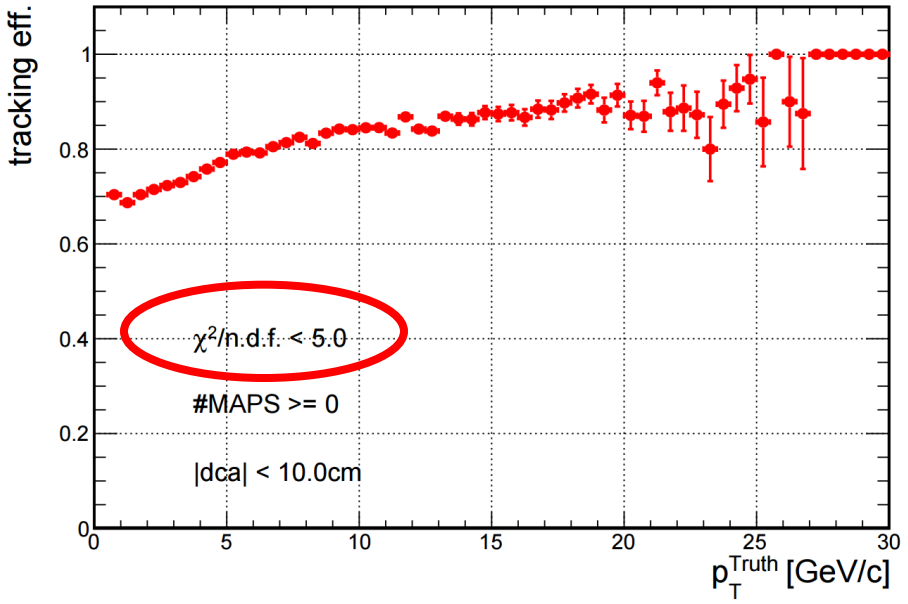
Tracking Efficiency within Jet cone

- 20 GeV Jet generated from |eta| < 0.6 embedded into 0-4fm Hijing events.

- denominator: # of pions from embedded jet, |eta| < 1.0
- numerator: # of tracks associated with denominator and some cuts listed in the plot.







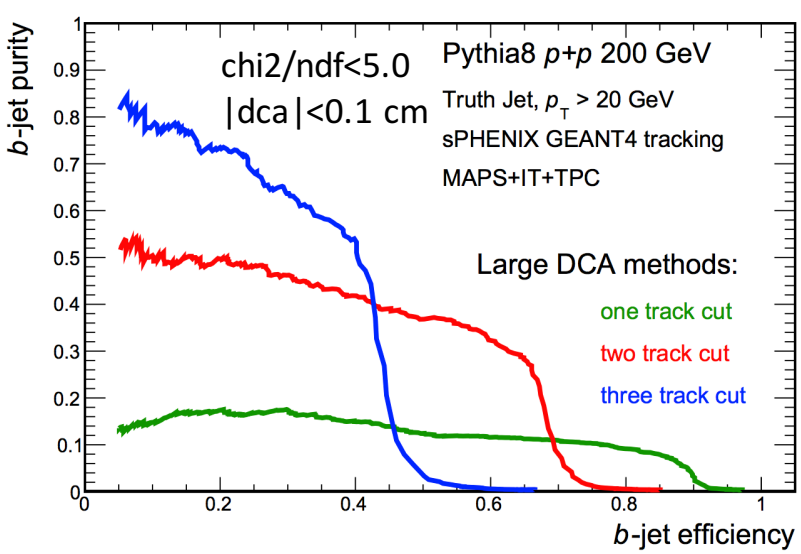
b-jet tagging: large DCA track counting method

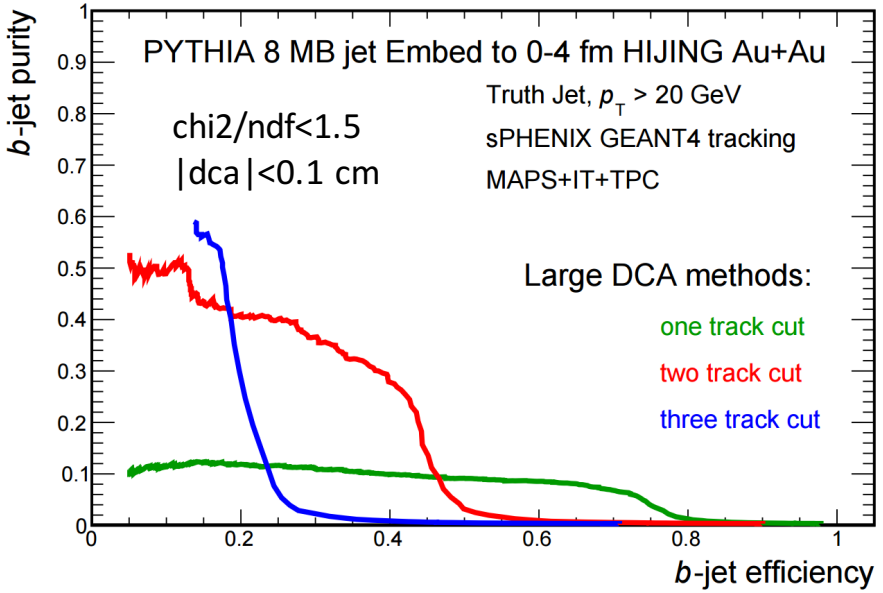
Status:

- 200k Jet embedded in central Hijing events

/sphenix/user/yuhw//taxi/BJetTagging/output/tracking_1/hijing_pro_1_anatrain_part_?/SvtxTracks_*.root

- preliminary b-jet tagging performance plot for Hijing updated:
  - has to apply tighter chi2/ndf cut to remove tails caused by fake clusters





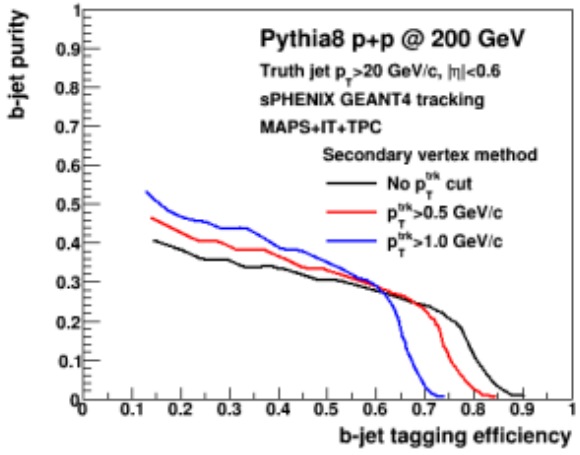
b-jet tagging: secondary vertex method

Improved performance for pp with updated refitting module:

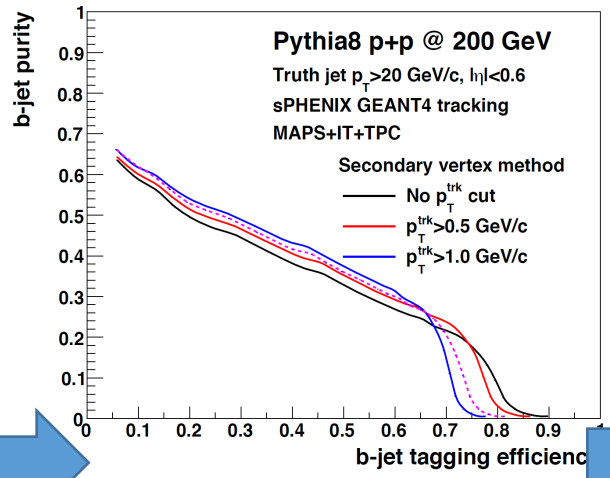
- https://github.com/sPHENIX-Collaboration/coresoftware/pull/239
- Change default fitting method to DAF
- Exception handling, fix bugs

Hijing performance generated.

p+p curve in Sept review

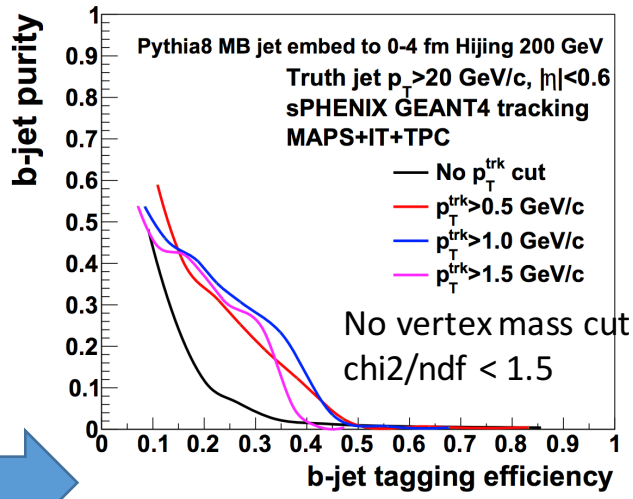


New p+p curve after fix



Fitter-inefficiency fix

Current Performance

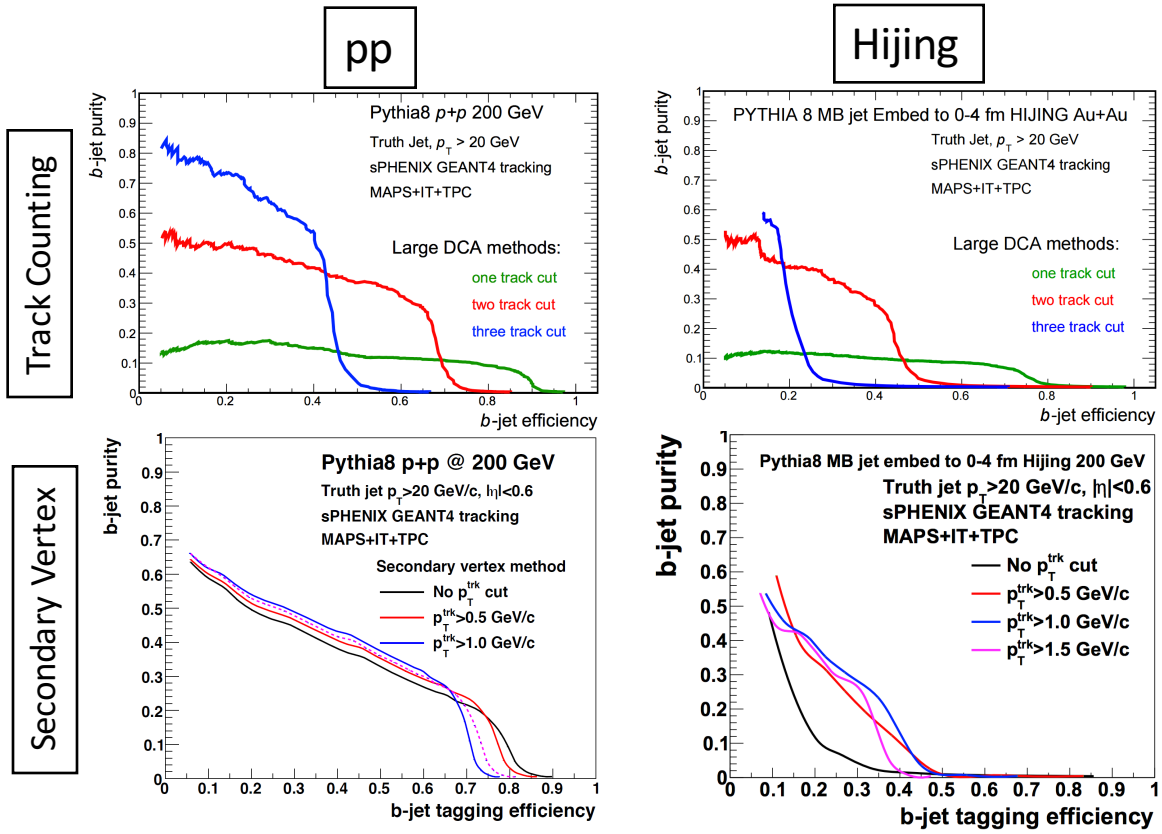


Embedding in central HIJING

Summary

b-jet tagging: For the MAPS MIE proposal, pp plot finalized, Hijing plot generated and near finalized.

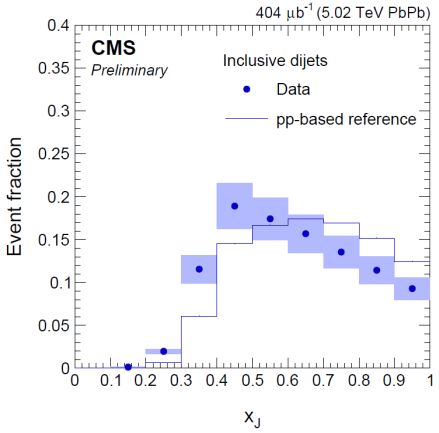
Darren is working on di-b-jet correlation; Xuan is working on b-jet-B correlation. Looking forward talks next Tue. Simulation meeting: https://indico.bnl.gov/conferenceDisplay.py?confId=2678

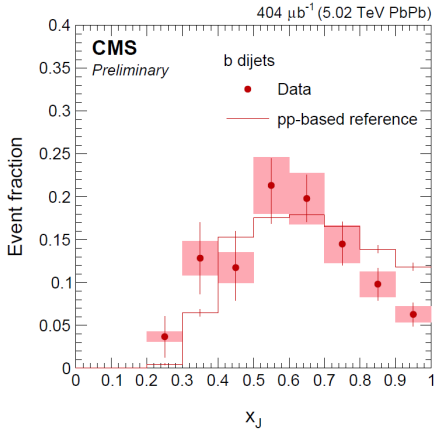


Backups

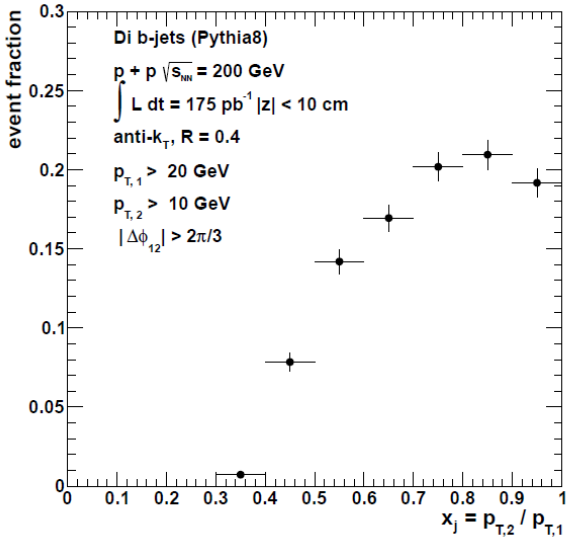
Di-*b*-jet asymmetry: sPHENIX projection

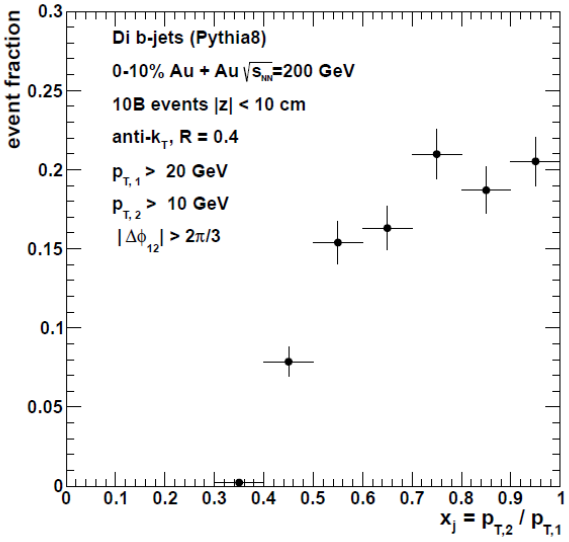
CMS-HIN-16-005
July 2016





On-going sPHENIX projection
- By Darren McGlinchey (UCB)
- Pythia8 (HardQCDBBar)
- Fast sim. (truth jets)
- Assuming di-b-jet tagging perf.
  - Efficiency 50%
  - High purity (100%)
- R_{AA} = 0.6 assumed
- sPHENIX proposal lumi. (100B MB)

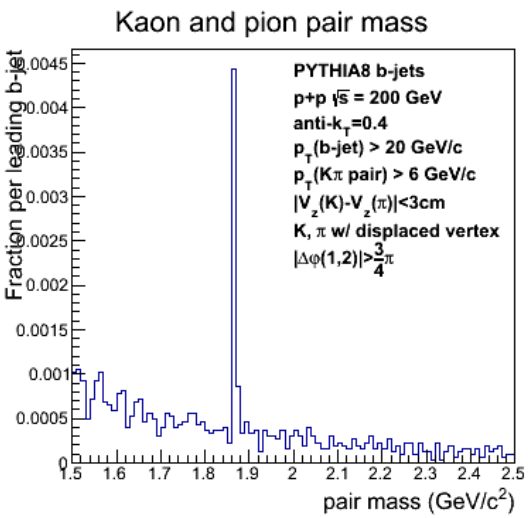


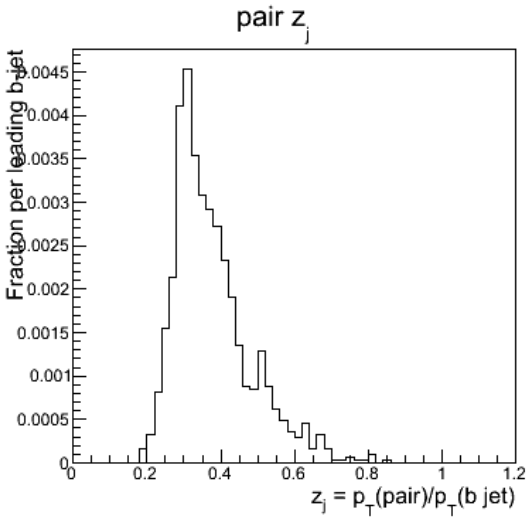


- For $p+p$ use integrated luminosity of $\int \mathcal{L}_{pp}\, dt = 175\ \mathrm{pb}^{-1}$
- For 0-10% Au+Au use $n+n$ equivilent luminosity of $\int \mathcal{L}_{nn}\, dt = N_{evt}^{AuAu} * \langle N_{coll} \rangle / \sigma_{nn} = 10\mathrm{B} \times 962/42\mathrm{mb} = 229\ \mathrm{pb}^{-1}$

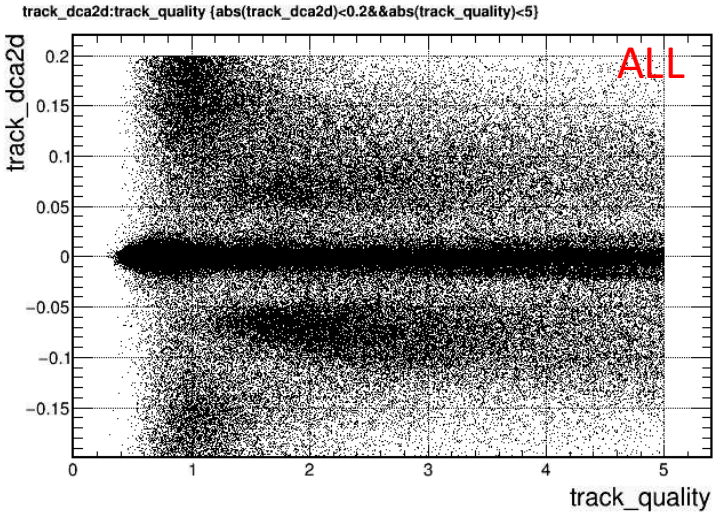
Non-prompt D-meson tagging

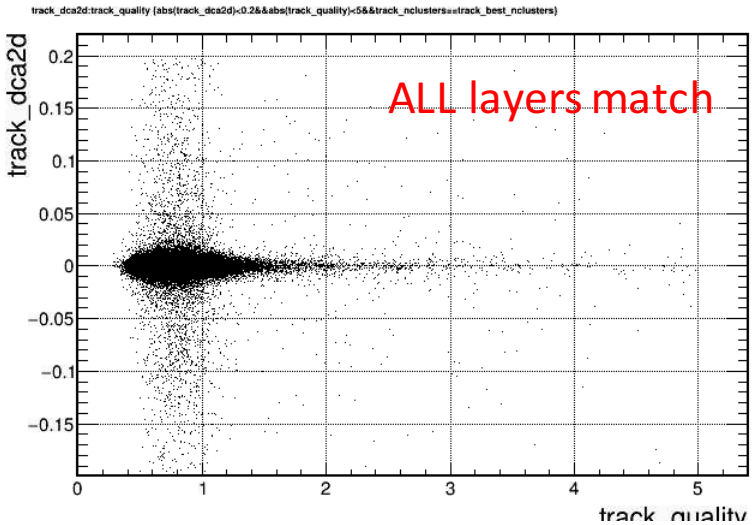
- Xuan Li (LANL) also started investigation of correlation of b-jet in correlation of B-meson or a non-prompt D-meson (→pi + K)
- In jet cone: b->B hadron fragmentation and modification in medium
- In opposite hemisphere: suppression of $g/q \rightarrow b\bar{b}$ jet, enhance *b*-jet tagging purity, p_T-imbalance and constraint energy loss.
- These initial investigations may lead in a set of projection plots for the full proposal

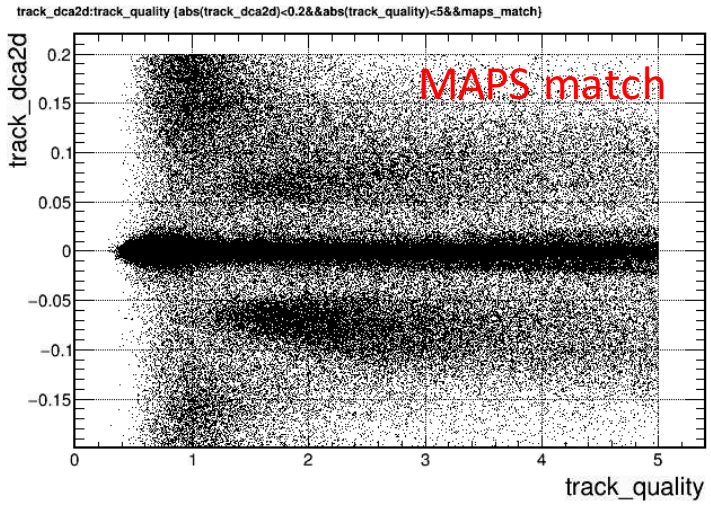


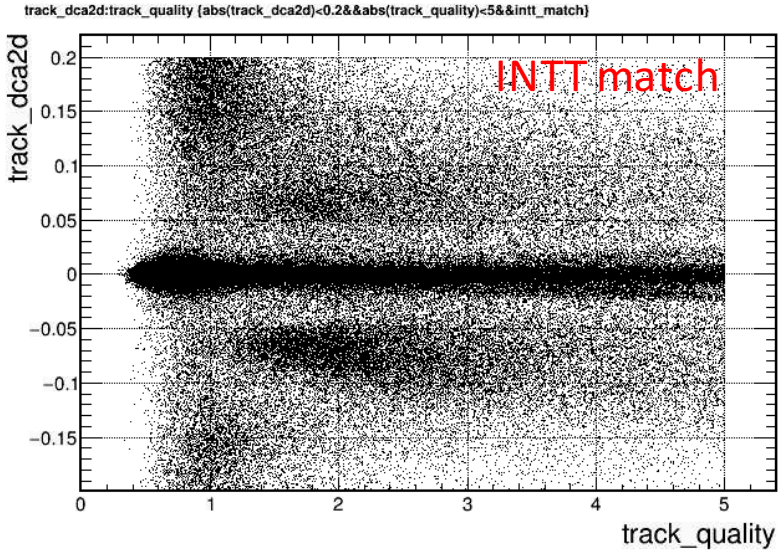


Tails caused by fake clusters





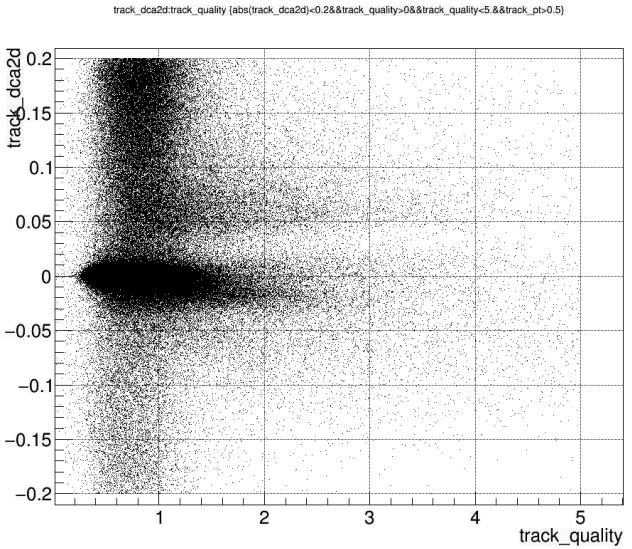


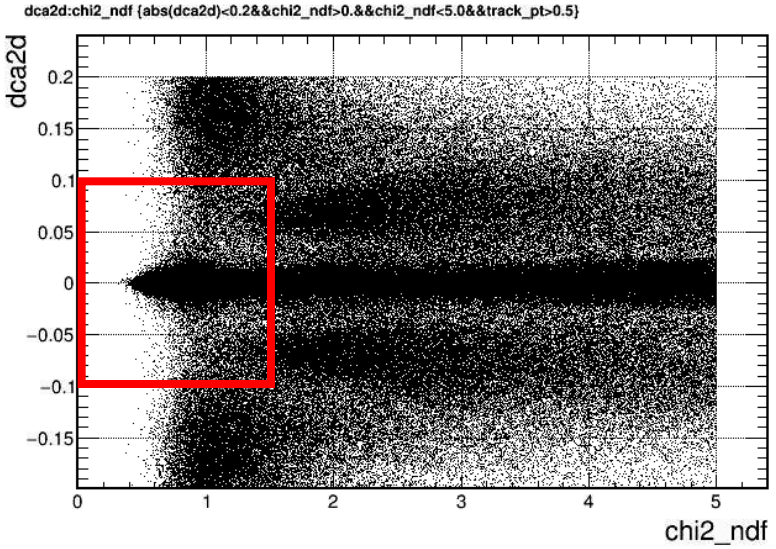


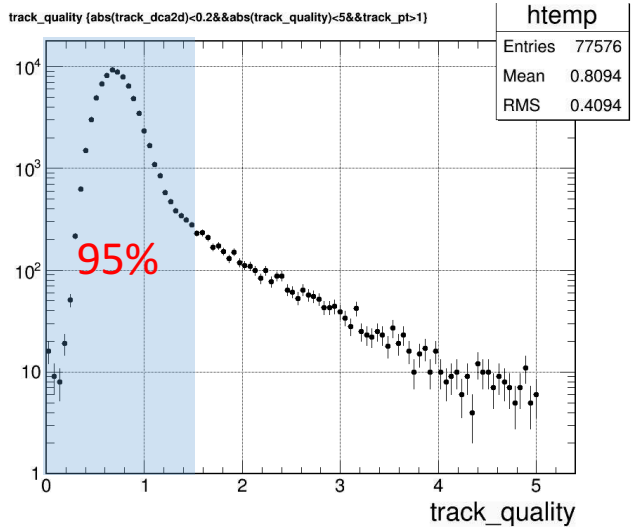
Original

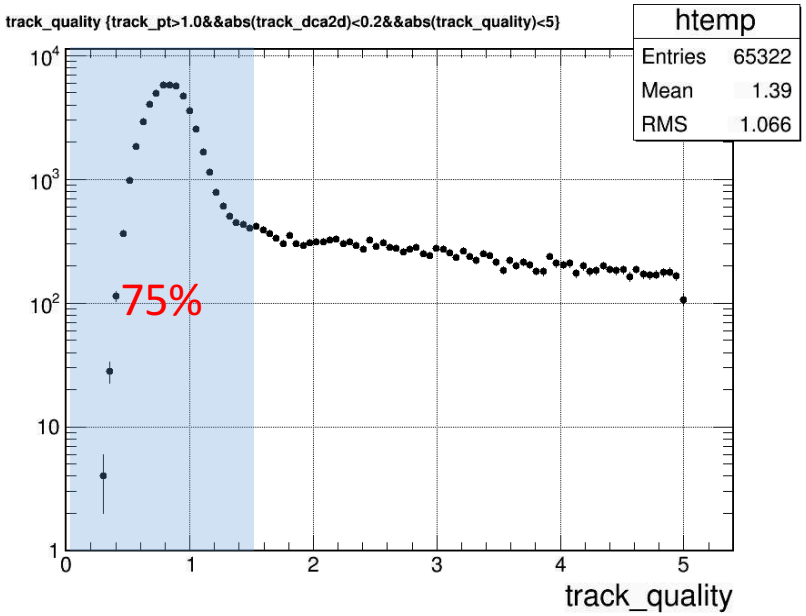
Refitting

pT>0.5





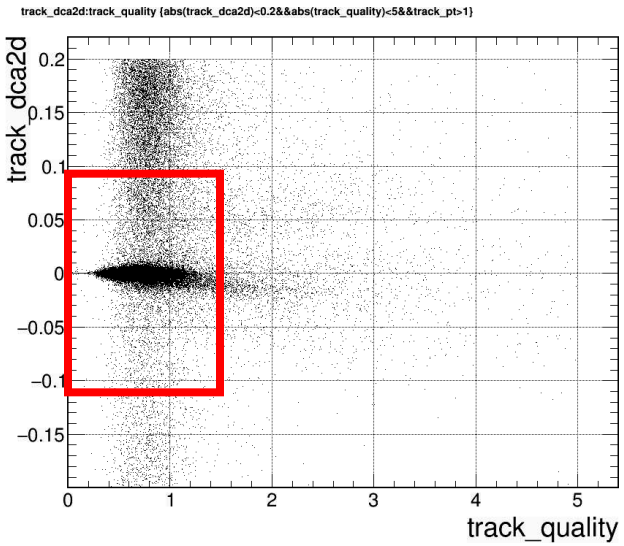


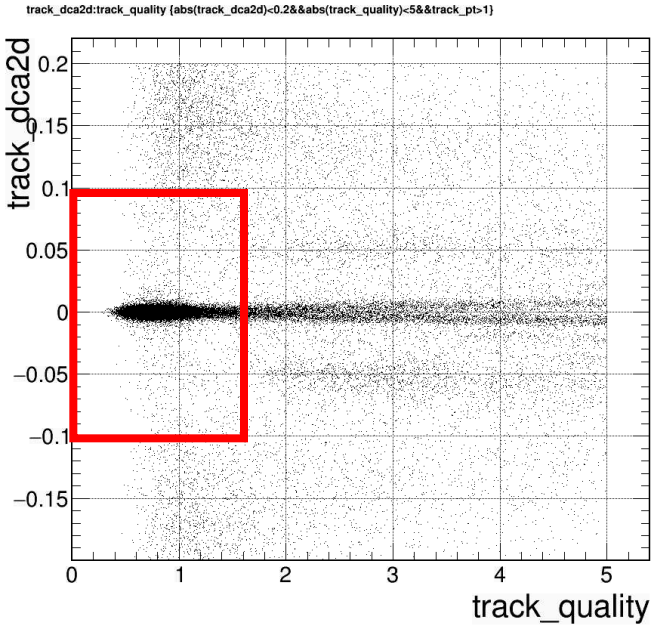


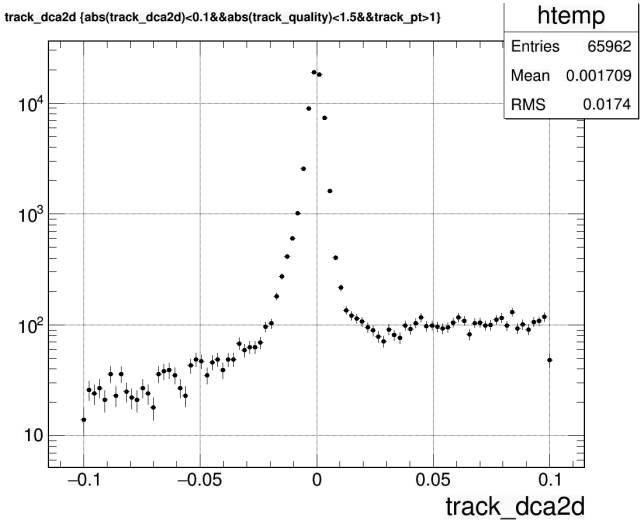
Original

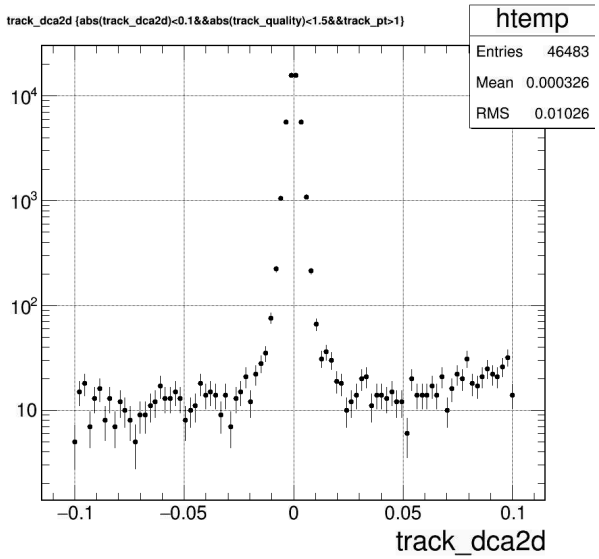
Refitting

pT>1.0GeV

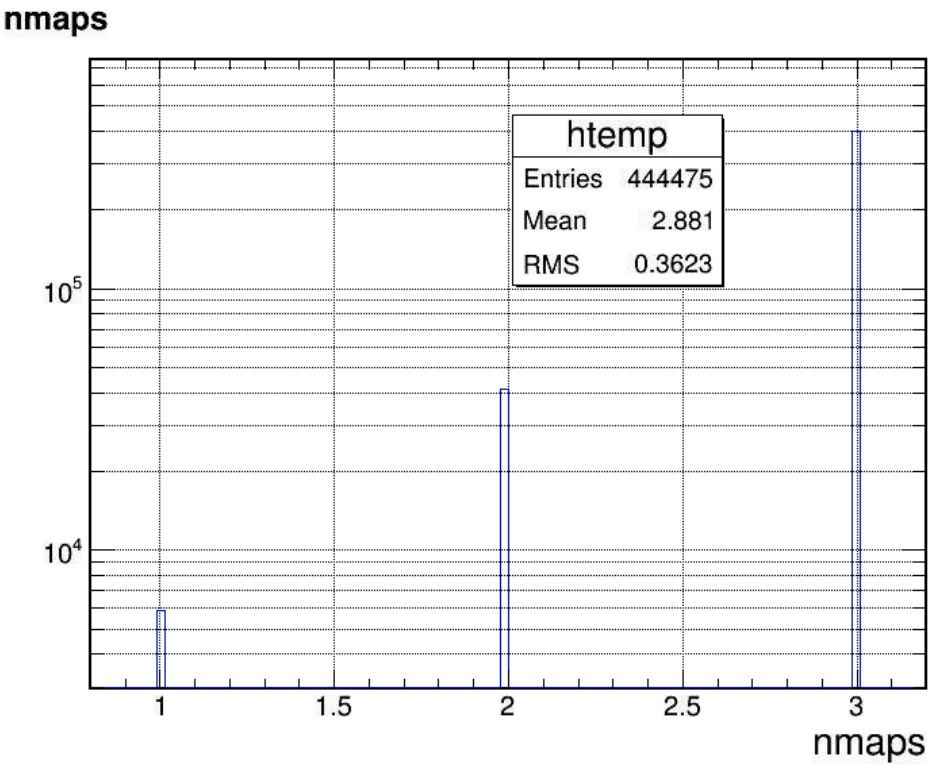




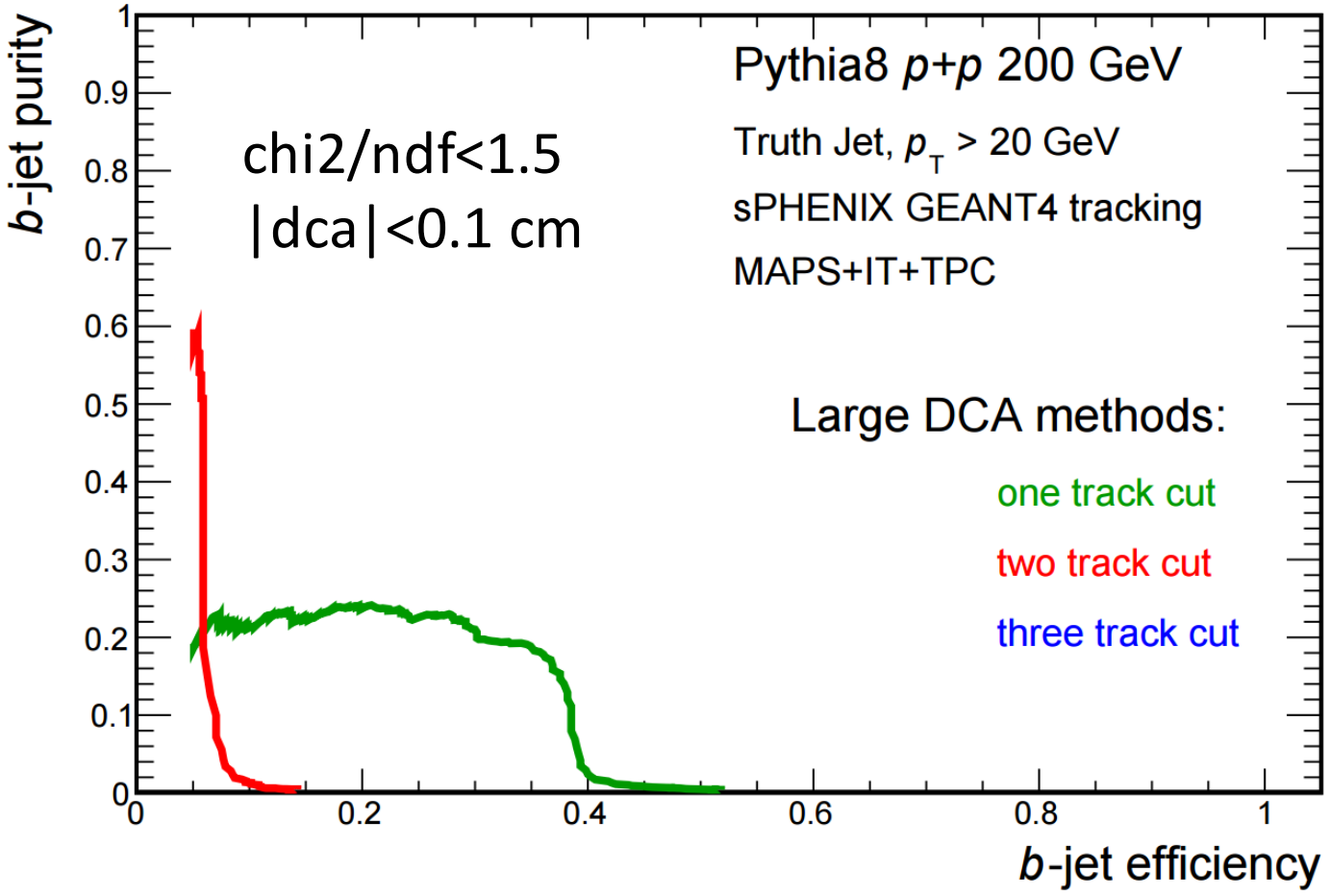




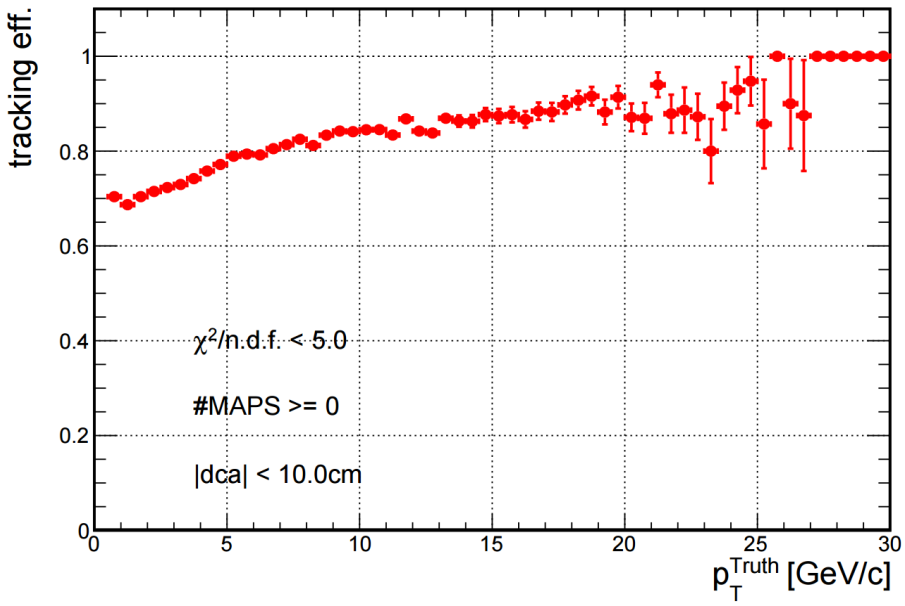
#MAPS distribution

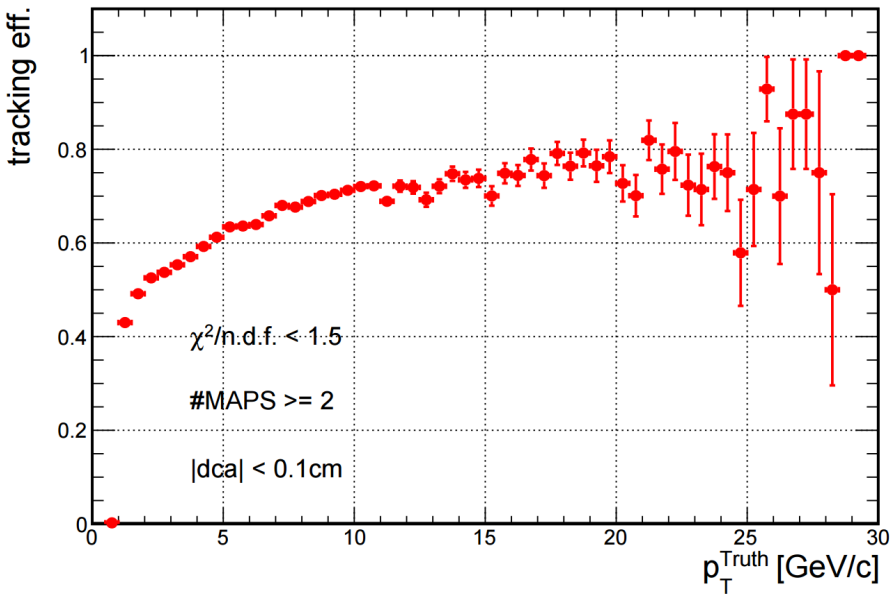


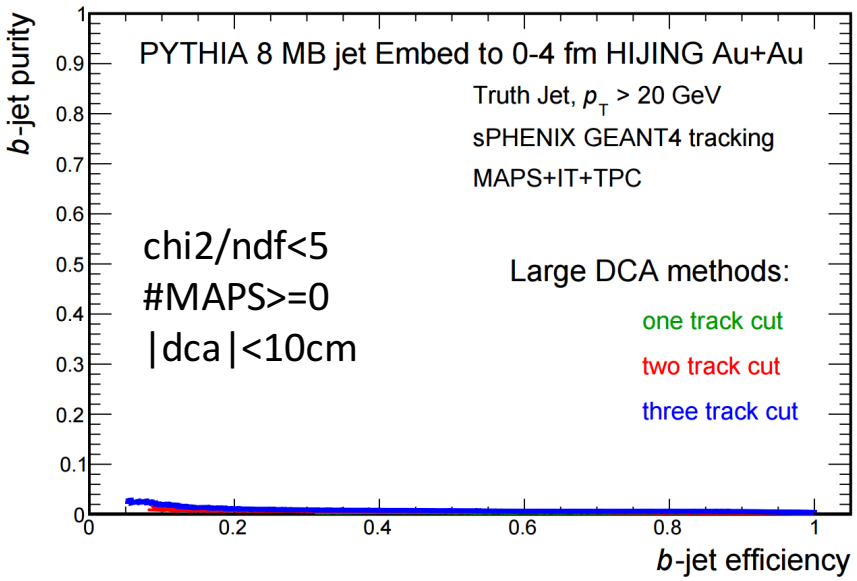
Large DCA track counting: chi2/ndf < 1.5

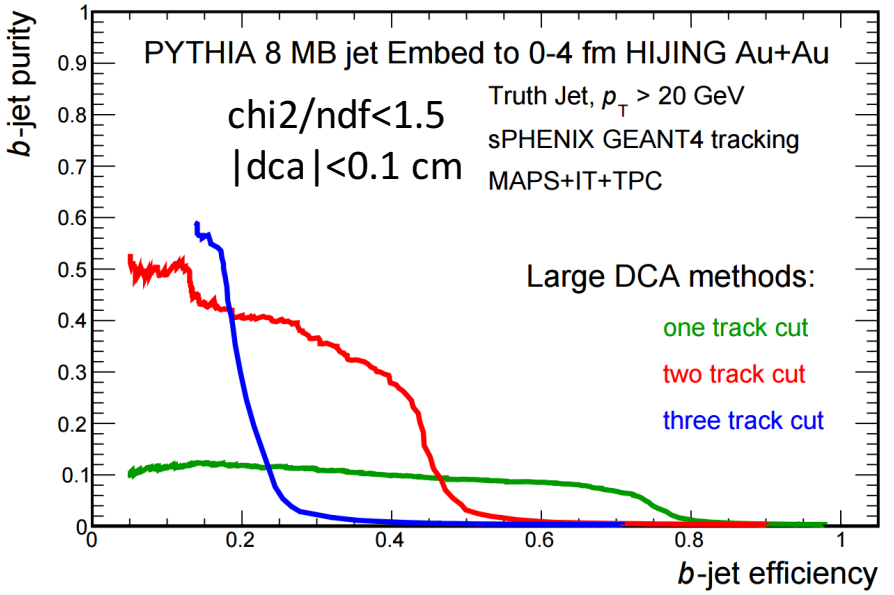


Large DCA track counting: optimization



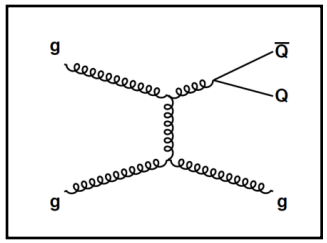


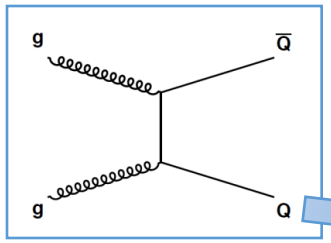


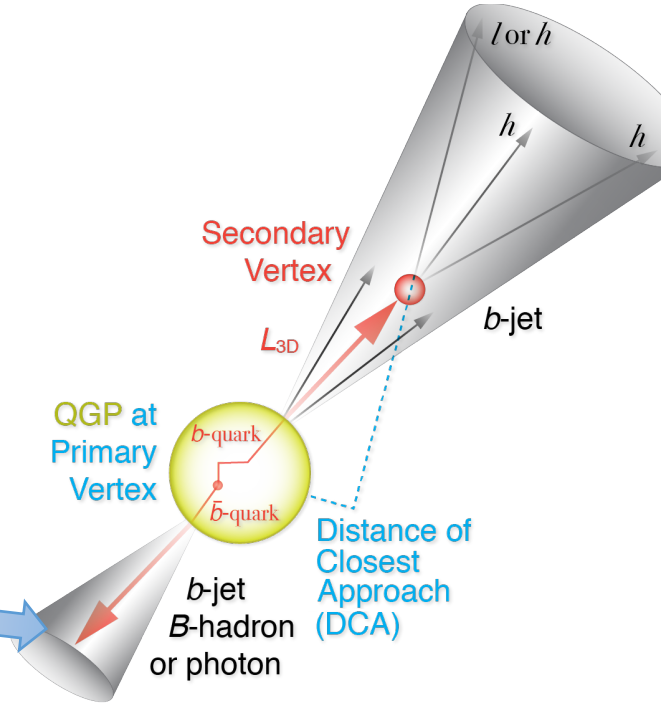


b-jet correlation

- Event topology to select *b*-quark jet
  - *b*-jet in correlation with opposite-going *B*-hadron, *b*-jet and photon
- sPHENIX provides good acceptance on *b-di*-jet and *b*-jet – non-prompt-*D* correlations
- Helps on purity of jet and *b*-tagging too
- Near term goals: fast-sim projection

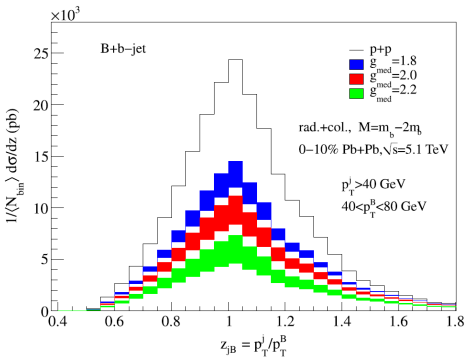






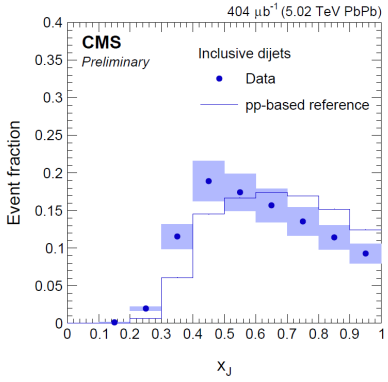
b-jet + *B*-hadron, model

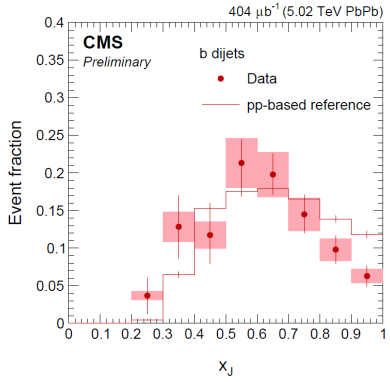
Physics Letters B750 (2015) 287–293



b di-jet, CMS 2016

CMS PAS HIN-16-005





di-jet acceptance in sPHENIX

sPHENIX scientific proposal